



# Repurposed Switch-Mode Power Supply

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## SUMMARY

Building your own switch-mode power supply (SMPS) can be fraught with disappointment and frustration. Even with modern ICs designed to make SMPS design easier, you can still run into issues with PCB layout and circuit efficiency. This project demonstrates how you can build your own SMPS by using a charger you may have stuffed in a drawer somewhere.

Details on this project and more:

[Building Blocks: Switch Mode Power Supply](#)

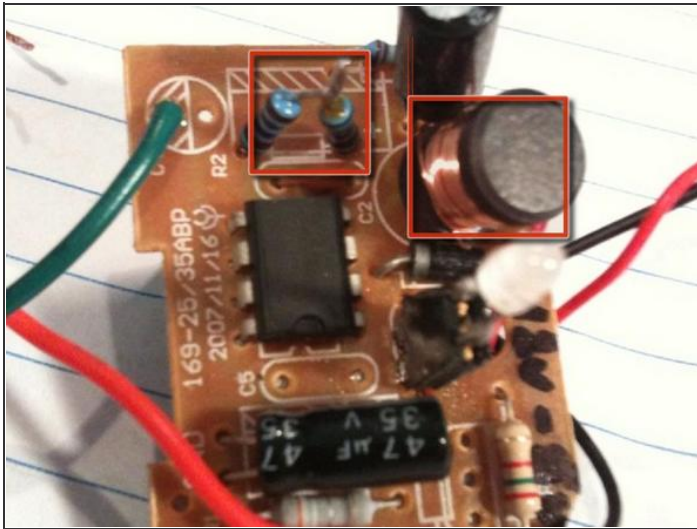
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## Step 1 — Repurposed Switch-Mode Power Supply



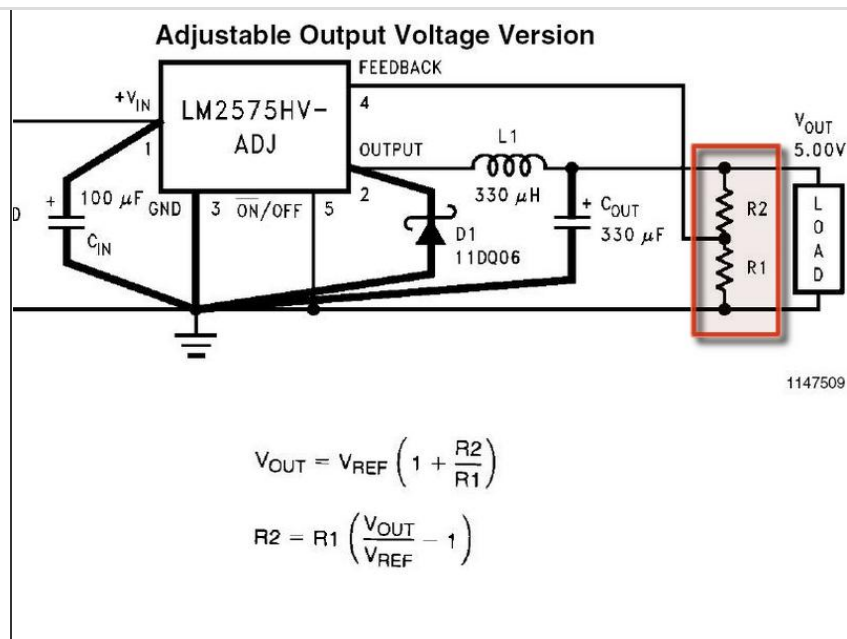
- First, you must find a car charger that you don't really want anymore. This is mainly because you will be tearing it apart and it will be useless for charging.
- This is a picture of the type of charger that I had in the bottom of my junk drawer. The nice thing about these chargers is that the input voltage is 12V because it's standard car voltage, and the output voltage is 5V because it's standard USB voltage. Pretty sweet.
- Warning... Some chargers simply use a 7805 or equivalent circuit. These are LDO regulators and just burn up the extra voltage as heat. That kind of defeats the purpose, no?

## Step 2



- Now, take the charger apart and you will find a couple of things that will positively identify the circuit as being an SMPS.
- The first giveaway is the presence of an inductor. Most simple SMPS circuits make use of an inductor.
- The next giveaway is the presence of a potential/voltage divider in addition to the inductor. The voltage divider is used to set the output voltage.
- You can expect that this charger will use a very simple circuit, similar to the picture shown.
- The LM2575 simple switcher by National Semi is a good example of what you might find inside your charger. In my case, the chip was unmarked, but when I traced the PCB, it matched the example application schematic for the LM2575 almost exactly.

**Step 3**



- Now, you might be done at this point if you want a 12V to 5V SMPS. All you need to do is solder on your own connectors to the input/output points and go for it.
- If you need something other than 5V output (like me), then you need to take one more step.
- Notice the voltage divider on the output? You will need to replace one of those resistors based on what  $V_{out}$  value you want.
- The easiest way is to identify the value of  $R1$ , either by color code or by multimeter, and then use the second equation in the picture to calculate  $R2$ .
- For example: If I want to make this a 12V to 3.3V SMPS, my  $R1$  value is 1k ohms, and my  $V_{ref}$  is 1.23V, then my formula looks like this...  

$$R2 = 1000 \left( \left( \frac{3.3}{1.23} \right) - 1 \right)$$
- Through the magic of the Internet, I have already calculated  $R2$  for you and that is: 1682 ohms.
- I confess that I don't remember what the actual value of my  $R1$  resistor was, but I do remember that my  $R2$  resistor was 1000 ohms. Working backwards, that must mean my  $R1$  was about 600 ohms.

### Step 4

- I hope you found this project useful. I do have a couple of caveats to throw out there, though.
- Remember, this circuit was engineered to supply 5V to charge a cell phone. Most cell phones can charge at a low rate and at a high rate due to the fact that they are charged by USB.
- Basic USB 2.0 standards say that a device will be current-limited to 100mA unless a higher current is negotiated, in which case a maximum current of 500mA can be offered.
- Why is this important? Well, I guess there's really no way to tell if this circuit can handle 100mA, 500mA, or more. In my case, the markings on the chip were removed, so I was unable to look up any concrete information on it.
- I guess what I'm saying is to be careful with it. It'll likely power your AVR's, PIC's, Arduinos, etc., but I wouldn't try to run motors off it, or large LED arrays, etc.
- For more information on this, visit my blog at: [Ramblings of an E-Geek](#)

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